

REMARKS

Claims 34, 35, 37, 39, 41, 43, 45-53, and 55-71 are pending in this application. Claims 1-33, 36, 38, 40, 42, and 44 are hereby canceled without prejudice to subsequent presentation in a continuation or divisional application. Claims 34, 35, 37, 39, 46-48, 52, 53, and 55-57 have been rejected under 35 U.S.C. § 102. Claims 39, 41, 43, 45, 49, 50, and 51 have been rejected under 35 U.S.C. § 103. Claim 34 has been amended to specify that the repeating operation must occur at least twice for a total of at least three cycles. Support for this amendment may be found at, e.g., Figure 3, page 13, first full paragraph, and page 14. Claims 58-71 have been added. Support for independent claim 58 may be found at, e.g., page 11, first paragraph. Support for the added dependent claims may be found at, e.g., page 11, first paragraph; page 10, first paragraph; page 11, second paragraph; and, page 16, second full paragraph.

Applicants request withdrawal of the rejections based on remarks that follow.

35 U.S.C. § 102 Rejections

Claims 34, 35, 37, 39, 46-48, 52, 53, and 55-57 have been rejected under 35 U.S.C. § 102 as been anticipated by U.S. Patent No. 6,756,085 to Waldfried et al. ("Waldfried"). Applicants respectfully traverse these rejections.

The methods of the present invention involve a UV curing process in which the intensity of the UV radiation is modulated (e.g., oscillating) to produce high strength films. This described by claim 34, which recites in part:

"(a) exposing the dielectric film to ultraviolet radiation with a first light intensity during a first time increment;

(b) exposing the dielectric film to ultraviolet radiation with a second light intensity during a second time increment, wherein the first and second light intensities are different; and

(c) repeating (a) and (b) at least twice in a manner that provides modulated ultraviolet radiation exposure that significantly increases the hardness and modulus of the dielectric film."

As described in the specification, providing modulated or oscillating UV radiation as compared to continuous UV exposure result in stronger films with fewer deleterious effects. Specifically, films exposed to modulated UV radiation experience less film shrinkage, less

increase in dielectric constant, and higher mechanical strength (page 12, col. 4-8). In order to provide the modulated UV, the film is exposed to at least three cycles of the first and second intensities exposure increments. The at least three cycles include the exposing steps (a) and (b) and repeating (a) and (b) at least twice. A graphical example of the modulated UV is depicted in Figure 2, which shows repeated cycles of the higher and lower intensity exposure periods. In various embodiments described in the specification, the film is exposed to multiple cycles of the modulated UV – in specific examples, 3 cycles (90 seconds total exposure) or 6 cycles (180 seconds total exposure) (see page 14).

Walfried describes a single cycle UV cure process to improve the hardness and elastic modulus of a dielectric. In certain embodiments, after the cure process, the film may undergo a post treatment to remove unwanted polar species generated by the initial UV cure process and to further decrease the dielectric constant. This post treatment may be a second UV exposure (col. 8, lines 46-54). Thus, according to the Examiner, Walfried describes a two-step UV cure process.

The Examiner states that either the first or second exposure intensity of the claimed invention may be zero such that one UV cure step would be absent. Repeating steps (a) and (b) once would yield a two-step UV cure process as in Walfried. While Applicants dispute this interpretation of Walfried, to expedite prosecution, the claimed invention has been amended to recite exposing the film to at least three cycles of the first and second UV intensities.

Walfried in no way teaches or suggests exposing the film to at least three cycles of the first and second UV intensities. At most, in certain embodiments when unwanted polar species are present, Walfried describes a two-step UV cure process that corresponds to only one cycle of the first and second UV intensities. Even in circumstances where the first or second intensity is zero, Walfried at most describes exposing the film to two cycles. Walfried does not suggest or discuss any benefit of repeating any post UV cure treatment. Therefore, Applicants submit that Walfried does not anticipate claim 34.

Claims 35, 37, 46- 48, 52, 53, and 55-57 depend on claims independent claim 34. Because Walfried does not anticipate claim 34, it does not also anticipate any of the dependent claims. Therefore, Applicants respectfully request the rejections under 35 U.S.C § 102 be withdrawn.

35 U.S.C. § 103 Rejections

Claims 39, 41, 43, and 45 have been rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,756,085 to Waldfried et al. ("Waldfried"). Examiner states that Waldfried discloses these claimed inventions except for discovering an optimum value of an effective variable, which involves only routine skill in the art. Claims 49-51 has been rejected under 35 U.S.C. § 103 as being unpatentable over Waldfried in view of U.S. Patent Publication No. 2002/0141024 to Retschke et al. ("Retschke"). Applicants respectfully traverse these rejections.

In regards to claims 39, 41, 43, and 45, Applicants disagree with the statement that Waldfried discloses these claimed inventions except for a variable. As discussed above, Waldfried discloses at most exposing a film to two cycles of UV intensities while the claimed invention requires at least three cycles. Therefore, Waldfried alone does not disclose the claimed invention.

Applicants also respectfully disagree with the statement that discovering the optimum value of the effective variables of claims 39, 41, 43, and 45 involve only routine skill in the art. Applicants submit that Examiner's reliance on the level of routine skill in the art is misplaced. More input than routine variation of parameters is required to determine the values in claims 39, 41, 43, and 45. In any case, because Waldfried does not disclose the claimed invention, Applicants request these rejections be withdrawn.

In regards to claim 49-51, Examiner relies on Waldfried in view of Retschke to form the rejections. The Examiner concludes that it would be obvious to combine the teachings of Retschke with Waldfried to reach the claimed invention.

First, Applicants submits that Waldfried, in view of Retschke, does not disclose the claimed invention or render it obvious in light of the fact that Waldfried discloses exposing a film to two cycles of UV intensities while the claimed invention requires at least three cycles.

Further, Applicants submit that it is not obvious to combine the teachings of Retschke with Waldfried. Retschke relates to writing of patterns, in the form of modulated data, onto printed circuit boards by scanning a laser across a photosensitive surface. Retschke discusses modulators that modify the laser beam or a portion of a small laser beam depending on data to be written. Applicants submit that modulating a scanning laser beam on printed circuit boards is not relevant to UV cure of dielectric materials on a wafer. The light exposure to write one pixel of data and to change mechanical properties of porous dielectrics are significantly different such that one of skill in the art would not be motivated to combine these references in the manner the Examiner suggests.

For at least the reasons given above, Applicants submit that claims 39, 41, 43, 45, and 49-51 are patentable over the cited art and request that the Examiner withdraw these 35 U.S.C. § 103 rejections.

Conclusion

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
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